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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/663,809

09/17/2003

Masanobu Nishitani

116927

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25944 7590 01/21/2009

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EXAMINER

SAINT CYR, LEONARD

ART UNIT

PAPER NUMBER

2626

MAIL DATE

DELIVERY MODE

01/21/2009

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/663,809	<b>Applicant(s)</b> NISHITANI ET AL.	
	<b>Examiner</b> LEONARD SAINT CYR	<b>Art Unit</b> 2626	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 22 October 2008.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1,4, 6 -9 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,4, 6 -9 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 09/17/03 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                     | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

## DETAILED ACTION

### *Response to Arguments*

1. Applicant's arguments filed 10/22/08 have been fully considered but they are not persuasive.

Applicant argues that Shinoda et al., do not suggest setting plural types of the Gaussian distribution numbers from a predetermined value to a maximum distribution number for each of the plurality of states constituting the HMM (Amendment, pages 5, and 6).

The examiner disagrees, since Shinoda et al., disclose "parameters of the mixture distribution HMM are trained with the ordinal procedure. In this HMM, **number of distributions in each state has predetermined sufficiently large values independent of the state**" (page 3, section 4, paragraph 2).

Applicant argues that Shinoda et al., do not suggest that the second term on the right side of the equation being multiplied by a weighting coefficient alpha, and the third term on the right side being omitted (amendment, pages 6, and 7).

The examiner disagrees, since Shinoda et al., disclose "the second term is **multiplied by penalty coefficient  $\alpha$  in order to control the total number of Gaussians for all HMM states**"; (page 3, lines 10, and 11). And equation 5 shows that the third term has been omitted from the approximation length of the mixture Gaussian distribution formula (see page 3, lines 1 – 10).

***Claim Rejections - 35 USC § 103***

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

3. Claims 1, 4, 6- 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shinoda et al., (HMM Size Reduction using MDL Criterion, Japan, March 2002).

As per claim 1, Shinoda et al., teach an acoustic model creating method of creating an HMM (Hidden Markov Model) by optimizing, for each state, Gaussian distribution numbers of the respective states constituting the HMM and retraining the optimized HMM using training speech data, the method comprising:

setting plural types of the Gaussian distribution numbers from a predetermined value to a maximum distribution number for each of a plurality of states constituting the HMM (“model having a large number of distributions trained with sufficient training data”; page 1; introduction, lines 19 – 23; page 3, section 4, paragraph 2);

obtaining a set of respective training speech  $xN$  by matching in time series a plurality of the training speech data with respective states of an HMM having any one of the Gaussian distribution numbers from the predetermined value to the maximum distribution number (“large number of distributions”; page 2, section 3, lines 1, and 2; page 1, lines 19 - 23);

computing a description length for each of the plurality of states; each state having the plural types of Gaussian distribution numbers using a Minimum Description

Length criterion applied to the data  $x_N$  ("Minimum Description Length criterion minimum is selected for each state"; page 1; introduction, lines 23, and 24);

constructing the HMM in accordance with the state having the Gaussian distribution number whose description length is minimum, selected for every state ("re-estimate all HMM parameters"), and retraining the constructed HMM using the training speech data ("re-training HMM"; page 4, lines 5 – 7; page 5, lines 8 – 10); and

performing speech recognition using the retrained HMM (page 4, section 5, lines 1, and 2);

wherein the Minimum Description Length criterion, a description length  $l_i(x_N)$  using a model  $i$  when a model set  $\{1, \dots, i, \dots, I\}$  and data  $x_N = \{x_1, \dots, x_N\}$  ( $N$  being a data length) are given is expressed as the following general equation,

$$l_i(x_N) = -\log P^{(i)}(x_N) + \frac{1}{2} \log N + \log I.$$

$\theta(i)$ : parameter of model  $i$ .

$\theta(i)$ =maximum likelihood estimate of  $\theta_{1,i}, \theta_{\beta,i}$

$\beta(i)$ : dimension (degree of freedom) of model  $i$

and in the general equation that computes the description length, the model set  $\{1, \dots, i, \dots, I\}$  is considered as a set of states in which plural types of the Gaussian distribution numbers from a predetermined value to the maximum distribution number are set for a predetermined state in a predetermined HMM, where, when the number of types of the Gaussian distribution numbers is  $I$  ( $I$  is an integer satisfying  $I \geq 2$ ), then  $1, \dots, i, \dots, I$  are symbols that specify the respective distribution number types from a first type to an  $I$ -th type, and the general equation is used as an equation for computing the

description length of the state having an  $i$ -th type of distribution number out of  $1, \dots, i, \dots, I$ , the second term on the right side of the general equation being multiplied by a weight coefficient  $\alpha$  (“the second term is **multiplied by penalty coefficient  $\alpha$** ”; page 2, section 3 – page 3, line 11).

Shinoda et al., does not specifically teach selecting a state having the Gaussian distribution number whose description length is minimum, for every state. However, since Shinoda et al., disclose selecting a node set which makes the description length minimum; and defining a distribution set corresponding to the selected node set as a distribution of the state (page 4, lines 4 – 6). One having ordinary skill in the art at the time the invention was made would have found it obvious to select a state having the Gaussian distribution number whose description length is minimum in Shinoda et al., because that would help re-estimate all HMM parameters using the selected node set or state (page 4, line 7).

As per claim 4, Shinoda et al., further disclose that the third term on the right side being omitted (equation 5 shows that the third term has been omitted from the approximation length of the mixture Gaussian distribution formula; see page 3, lines 1 – 10).

As per claim 6, Shinoda et al., further disclose that the Gaussian distribution numbers being the maximum distribution number (“large number of distributions”; page 1, lines 19 – 23).

As per claim 7, Shinoda et al., further disclose that the HMMs being syllable HMMs (“phonological”; page 5, lines 3 – 7).

As per claim 8, Shinoda et al., further disclose that the syllable HMMs having the same consonant out of the states constituting the syllable HMMs tie an initial state or at least two states including an initial state in the syllable HMMs, and the syllable HMMs having the same vowel tie a final state of the states having self loops or at least two states including the final state in the syllable HMMs (“initial model”; page 4, section 4, line 5 – page 4, line 7)

As per claim 9, Shinoda et al., further disclose that a speech recognition device recognizes input speech using HMMs (Hidden Markov Models) as acoustic models for feature data obtained by feature analysis of the input speech, the HMMs created by the acoustic model creating method according to claim 1 being used as the HMMs which are the acoustic models (“used acoustic feature”; page 4, section 5, lines 1 - 6).

### ***Conclusion***

4. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not

mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to LEONARD SAINT CYR whose telephone number is (571) 272-4247. The examiner can normally be reached on Mon- Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richemond Dorvil can be reached on (571) 272-7602. The fax phone number for the organization where this application or proceeding is assigned is (571)-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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01/07/09



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